HAND GESTURE BASED USER INTERFACE SYSTEM

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ABSTRACTS

This project is to describe about the hand gesture based on user interface that would able to replace mouse. In this project, we would focus to new system which we will use own hand to replace mouse and control the mouse pointer to do all mouse tasks in the computer via webcam. We would discuss about what advantages of system among existing system through several ways and more convenient than usual system. The technology that used is related in using Webcam and Opencv libraries. I have been using Rapid Application Development (RAD) in developing my project. There are four phases in this model: Requirement Planning, User Design, Construction Phase, and Cutover Phase. Rapid Application Development is slightly different from the Systems development life cycle (SDLC). The Rapid Application Development is focus more on implementation and construction but less on design and documentation. Last but not least, I have arranged a time schedule to help me in developing the project so that I would be able to finish my project in time.

ABSTRAK

Projek ini adalah untuk menggambarkan mengenai isyarat tangan berdasarkan antara muka pengguna yang akan dapat menggantikan tetikus. Dalam projek ini, kita akan melihat ke dalam sistem baru yang kita akan gunakan tangan untuk menggantikan tetikus dan mengawal penunjuk tetikus untuk melakukan semua tugas-tugas tetikus dalam komputer melalui webcam . Kami akan membincangkan tentang apa kelebihan sistem antara sistem sedia ada melalui beberapa cara dan lebih mudah daripada sistem biasa. Teknologi yang terlibat akan berkaitan dalam menggunakan Webcam dan Opencv perpustakaan. Saya telah menggunakan Pembangunan Permohonan Rapid (RAD) dalam membangunkan projek saya. Terdapat empat fasa dalam model ini : Perancangan Keperluan , Rekabentuk Pengguna, Fasa Pembinaan dan cantas Fasa . Pembangunan Permohonan Rapid adalah sedikit berbeza daripada kitaran hayat pembangunan sistem (SDLC). Permohonan Pembangunan Rapid adalah tumpuan lebih kepada pelaksanaan dan pembinaan tetapi kurang pada reka bentuk dan dokumentasi. Sebelum akhir laporan itu , saya juga telah mengatur carta Gantt untuk membantu saya dalam membangunkan projek supaya saya akan dapat menyelesaikan projek saya dalam masa.

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PART ONE

INTRODUCTION

1.1 **INTRODUCTION**

In this time and age, technology is constantly achieving newer heights. The computer is no exception, too. The traditional user interface devices, namely the mouse and the keyboard are replaced with even better devices, such as the touch screen. The development of new technologies have realized and focused on the natural interaction between computer and human. Natural interaction consists of eyes, face, speech, and so on. But, what device would feel more natural and intuitive than the hand gestures of users?

Hand gestures can be a new language to communicate with computer. Hand gesture is a new user-interface system which opens up a new direction for people to build the advanced device. For a successful communication, a sender and receiver must have the same set of information for particular gesture. Gesture is defined as a movement of body parts which is has certain message, to be communicated precisely between a sender and receiver. So that, message from each gesture is very important to understand what the computer need to do.

In the proposed system, the mouse pointer is controlled by user's hand by using hand gesture. Before that, the computer has to understand the instructions of each hand gestures. Through tracking and recognition by the computer, interaction between human and computer can be achieved

1.2 **Problem Statements And Objectives**

In the current computer age, the common input devices to operate a computer are the mouse and the keyboard. Without them, a computer is just a monitor.

Besides that, using a mouse can be hazardous. Some people might need to make small, exact movements with theirs hand, fingers, and thumb when they are running a program, such as Photoshop. Furthermore, by positioning, scrolling, and clicking the mouse repeatedly, the muscle can become tired and overworked.

The main aim of this project is to develop a hand gesture based on user-interface to control the mouse pointer.

The objectives of this project are as follows:

- To move the mouse pointer using hand gestures on the X and Y axis
- To select items using hand gestures in the Z axis
- To integrate the hand gesture based user interface with the existing operating system.

1.3 **Review Of Previous Work**

1.3.1 Gesture and Voice Based interactive System

Gesture and Voice Based Interactive System is an interaction system which is aimed at the simulation of mouse function certain gestures of the fingers and also using various voice tags. In this system, they applied color tapes on the fingers and use gesture detection and color tracking technique to simulate mouse functions. They use Java Sphinx framework for simulation of the mouse events besides using voice commands. (Sagar Badve, 2013)

1.3.2 Hand gesture Recognition Using Computer Vision

Hand gesture recognition using computer vision is a system which allows user to interact with the computer by using video camera to interpret one-handed side language alphabet and number gestures. The systems use an optical method which is more practical, cost effective, and has no moving parts. The hardware chosen in this system is a single color camera pointing down towards a desk surface a constant color with no special lighting. Detection of hand gestures are performed by comparing each RGB pixel values with ranges found. (Ray Lockton, 2001)

1.3.3 Mouse Simulation using Two Colored tapes

A Mouse Simulation Using Two Colored tape is a system which can also be identified as ubiquitous computing. This system uses two different color tapes on the fingers. One of the color tapes is used for controlling cursor movement while the relative distance between the two colored tapes will be used for click events of the mouse. The system uses only webcam to completely eliminate the mouse.
(Kamran Niyazi, 2012)

1.4 Current and limitation

Currently, there are many innovations that could replace the usual mouse to enable communication with the computer. Some of the existing systems consist of different small devices, such as gloves and color tapes. Needless to say, it is hard to operate a computer without any physical devices, other than the hands. In order to avoid situations like this, hand gesture based on user interface is another alternative to allow users to control the mouse pointer to operate the computer without any physical distance required.

1.5 Terminology

Abbreviation	Definition
HGBUI	Hand gesture based user -interface
UML	Unified Modelling Language
RGB	Red-Green-Blue
SRS	Software Requirement Specification
SDD	Software Design Description
RAD	Rapid Application Development
RUP	Rational Unified Process

1.6 Method approach

Table 1.1 below shows the comparison of process models that had been found on selecting the best process model for this project.

Table 1.1 Process Models

Source	Model	Stages	Scenario	Resource
(Mochal, 2001) (Bhakti, 2011)	Waterfall Model	5 Stages; Plan, Analyze, Design, Construct, Implement	Smaller systems with clearly verified requirements	When the software definition is stable, requirements and implementation of the product are both very well-understood. When requirements are fixed.
(Mochal, 2001)	RAD	4 Stages; Planning and Requirement Gathering, Design, Construction, Cutover	Smaller Systems	When a good visual prototype is needed. When client's involvement in an ongoing basis.
(Rajib, 2013) (Rooney, 2008)	RUP	4 Stages: Inception, Elaboration, Construction, Transition	Small parts of system that will be integrated into larger system	When system need web-enabled program development

From the models above, Waterfall Model is the oldest style model in the field of software engineering development. However once implementation phase started, it is relatively impossible to go back previous step. Hence if there's any error or problem in the design phase, system will get very complicated in implementation phase. RAD is more focused on developing small projects or large projects broken into smaller scale. Due to the goal of making development fast RAD focusses less on design and documentation and more on construction. RUP on the other hand covers both Waterfall and RAD's shortcomings by implementing iterative development and focusing more on architecture and risk management (Rooney, 2008). However RUP could result to more documentation, more design, and less on the software or system itself.

I used to develop in project is RAD Model and it is a very suitable to develop a system in a time constraint or limited amount of time. This model involves user's input along the way through development, prototyping, and other processes that could speed up the system or application development. RAD consists of four stages which are Planning and Requirement Gathering, Design, Construction, and Cutover. The details on every phase will be explained further in this report.

1.7 Scope of Project

This scope of this project is defined below;

- User

  - The user of this system will be use his/her own hand to control mouse pointer based on the user-interface.

- System

  - This system able to tracking and recognition of the user's hand.

  - This system will be able to understand the movement of gesture from the hands

  - This system able to use without physical distance required.

1.8 Outline of the Project

In this report, there are divided into 3 parts. The first part is told about the introduction, problem statement, objective and scope of the entire project. Meanwhile, review on existing systems and current system and limitation are also cover in this part. Besides, this part also contains the method of approach and terminology.

In second part, the main focus is discussed about the methodology have been used to develop the system. In addition, this part also explaining the user requirements, flow chart, diagrams and the method use for the whole development process.

The last part is about the conclusion of the technical report. This part will conclude and summarize the important point for the entire project.

PART TWO

REPORT BODY

2.1 Methodology

The model that I will use to develop my system is the Rapid Application Development Model (RAD) which I had mentioned and explain earlier in the method of approach above. The phases of the RAD model contain:

i) Requirement Planning
ii) User Design
iii) RAD Construction
iv) Transition / Cutover

The figure below shows the phases of the RAD model.

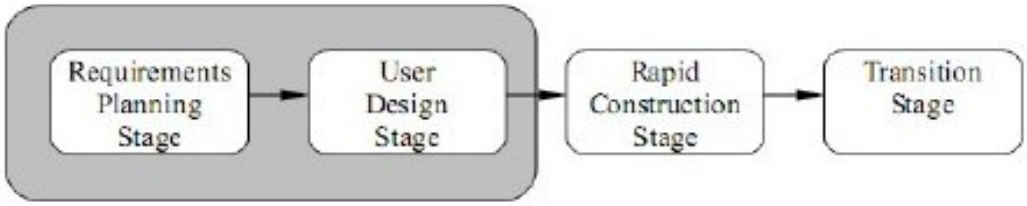


Figure 2.0 - The RAD life cycle phases.

RAD planning stage is to collect the system initialization process, the development of specific requirements. In additional, the phase defines the business functions and data of subject areas, the system will support and determine the scope of the system. Planning is the key to the success of a system development. So this stage should be appropriately.

During the design phase, the description of the alternative solution into a logical and physical system specification is converted. Complete the analysis created by the interaction of action defined charts and data. Preliminary layout design and program development system screen. Programmers can always return to the construction phase.

In construction phase, the code will be generated and a description of the final product interface. The design created in the design phase has increased and added.

The last stage is cut over phase. When the cut over phase, it need to all kinds of action, the comprehensive test, the end user, organizational change with the previous system, settle down until the new system parallel operation training.

2.2 Requirement Planning Phase

In this phase, I have taken the requirements from user so that they would be included in my system. As we know there are issues where the physical devices used to interact with the computer would hurt the user's hand, fingers, and thumb if the device is small for them. Also, the muscle would become tired when clicking, positioning, scrolling or typing repeatedly after sometime. For this system, the user only needs his/her hands to display the hand gestures. Then, the system will analyze the hand gestures through image processing and tracking and thus, recognize the hand gestures. The system then responds and follows the instructions that had been set from a database of hand gestures previously stored in the computer.

2.2.1 Modern Existing System

Based on the research studies, the primitive interactive methods with computer started with typing computer language. In that era, user was given the languages, such as C language to give instruction. Besides that, the language was very difficult to memorize because the languages were for computer and only computer can understand. After sometime, comes the advent of the mouse and joy pad, and users can now communicate easily with the computer by using human language and the pointer of the mouse to select the icons. However, this method was not enough to fulfill the best natural way for interaction between humans and computer. For the future purpose of easing interactive between human and computer, the gesture from the human parts began its development until now.

2.2.2 Analyzing and finalize requirement

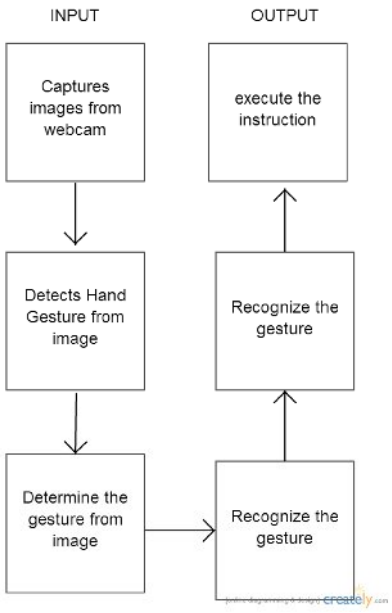
For the hand gesture method in the proposed system, each hand gesture represents different commands in the computer. The captured image from the webcam will be generated and processed. Then, the matching instructions will be run and thus allowing control through the mouse pointer. In this proposed system, the schedule had been properly arranged and the cost is very low due to the common hardware that can be easily found in the market.

2.3 User Design Phase

During this phase, the user interacts with the systems and develops models and prototypes that represent all the system process, input, and outputs. The RAD typically translates users need to working models. User Design is a continuous interactive process that allows users to understand, modify, and eventually approve a working model of the system that meets their needs. For this system, the images of hand gesture are taken from the webcam and translate into command to communicate with computer.

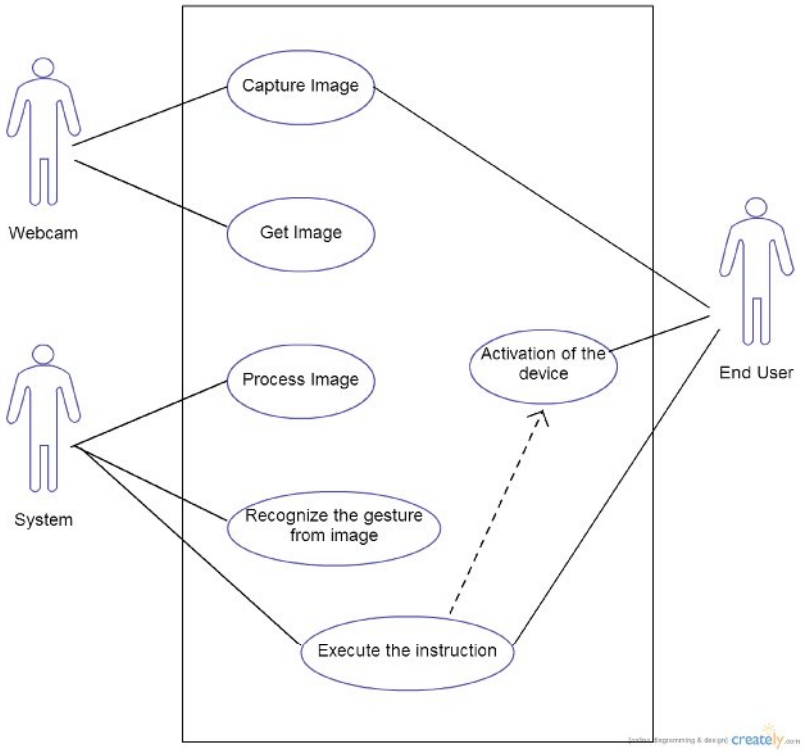
2.3.1 Block Diagram

Block Diagram is a diagram of a system, in which the principal parts of functions are represented by blocks, connected by the lines show the relationships of the blocks. The following shows the block diagram.

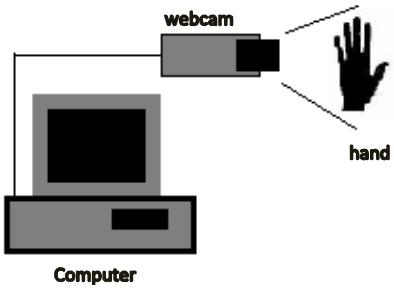


2.3.2 UML Use Case Diagram

UML use case diagram are used to describe the functionality of particular system. The following shows the functionality of the user of the system. The role of webcam is always on and capture image about hand gesture in front the camera continuously and pass the image to system. After that, the system plays a role as core and take image from webcam and process the recognition of hand and determine whether is gesture of hand or not so that it can implement the instruction to the computer to control the mouse pointer. End user just stands in front the webcam and uses their hand only.



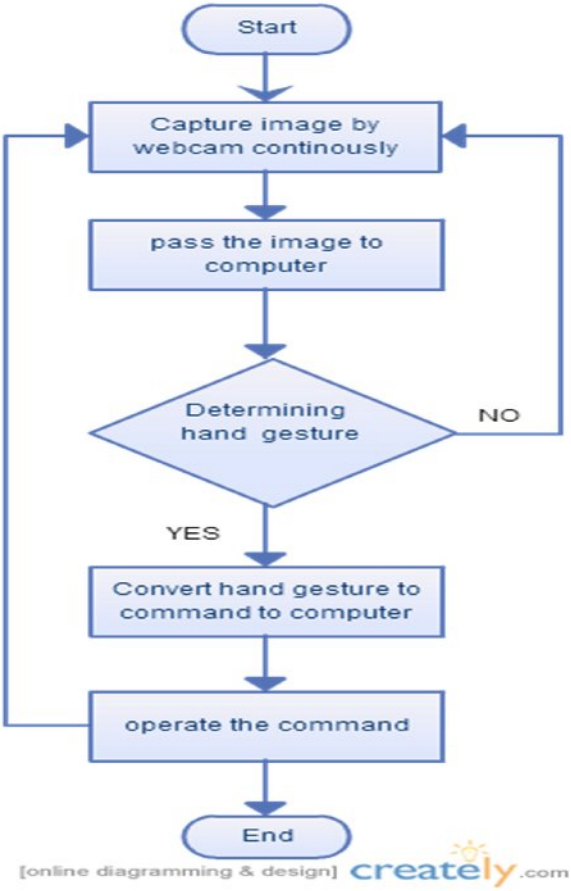
2.3.3 System Overview



In the figure above, the HGBUI system will involve the built-in webcam in the computer. The figure shows the role of the webcam to capture image continuously and pass those images to the computer to process the images processing and recognize the hand gesture. After that, the computer will perform the matching operation so that mouse pointer can be controlled by hand.

2.3.4 Flow Chart

A flow chart represents the flow of the activity that involves in a system. A flow chart is a design so that we can look further inside the system.



2.4 Material Used

Software and hardware tools are used to deliver and perform the system in higher efficiency level. The need is to use them judiciously to create good projects and have features such as usability, user friendliness and higher integration. The types of hardware and software that I used are listed as below:

2.4.1 Hardware

Device	Specification
Laptop	Lenovo G400S --Black Processor Intel Core i5 - 3230M 2.6GHz Memory 4GB DDR3 RAM Storage 1TB Serial - ATA Hard Disk Graphics NVIDIA GeForce GT 720M 2GB Graphics Optical Drive DVD Writter Display 14" HD Display (16:9) Wide Screen Bluetooth Yes Camera Integrated Web Camera Communications WiFi 802.11b/g/n, Ethernet Port Ports 2 x USB 3.0 Port 1 x USB 2.0 Port 1 x HDMI 1 x VGA 1 x Headphone / Microphone Combo Card Slot Multi in One Card Reader Software Genuine Windows 8
Webcam	1MP Fixed Focus CMOS camera on the laptop

2.4.2 Software

Item	Specifications
Microsoft Window 8	Support Architecture: -32bit(x86) -64bit(x86) Hardware Requirement : -1 gigabyte (GB) RAM (32-bit) or 2 GB RAM (64-bit) -16 GB available hard disk space (32-bit) or 20 GB (64-bit) -DirectX 9 graphics device with WDDM 1.0 or higher driver
Opencv	Opency 2.4.7
Microsoft office Home and Student 2010	-Microsoft office words 2010, -Microsoft office Power point 2010,
Microsoft Visual Studio 2010 professional	-64bits

2.5 Design Description

2.5.1 User interface of hand gesture

Figure below shows the “click mouse” screen.

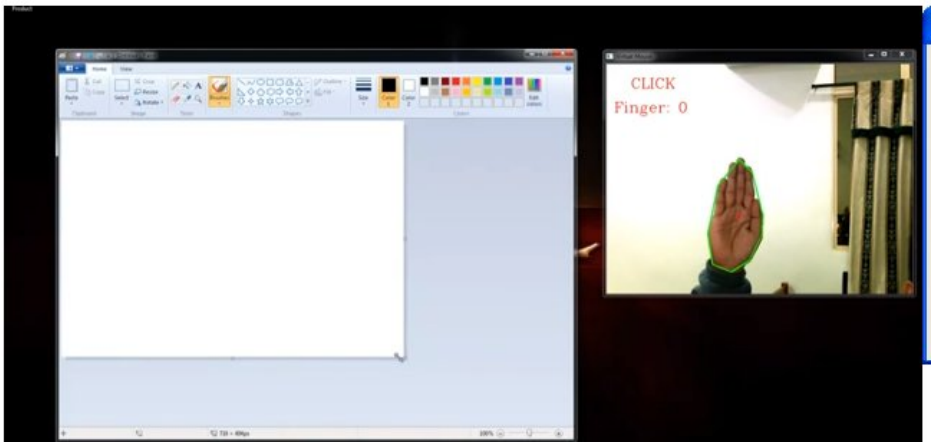


Figure blow shows the “ move the mouse without click screen.

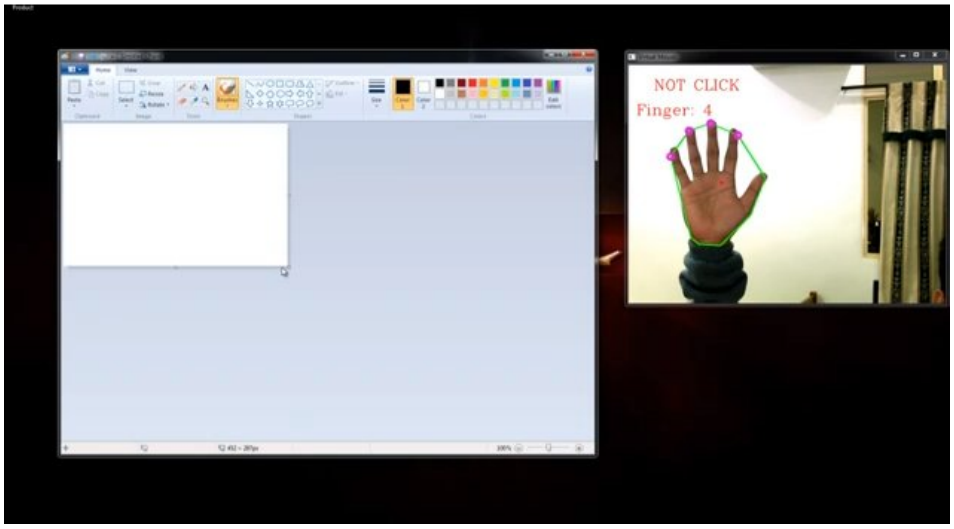


Figure below shows “moving the mouse with click” screen.

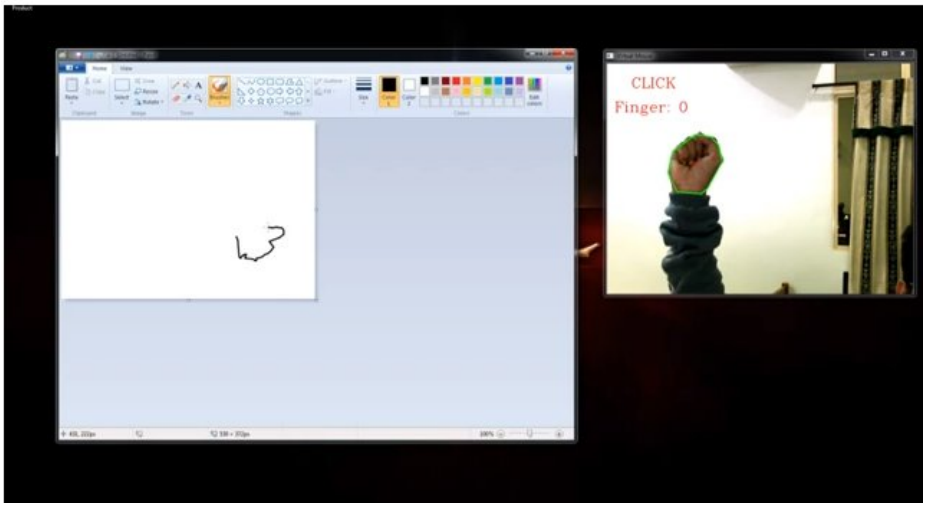


Figure below shows “Right-click” screen.